

What is claimed is:

[Claim 1] 1. A method of correcting errors in motion vectors due to camera panning, the method comprising steps:

- (a) identifying an error block that contains an error motion vector out of a plurality of blocks in a current video frame, each block in the current video frame containing a corresponding motion vector;
- (b) calculating a first average motion vector value of the motion vectors for all blocks in the current video frame that are not error blocks;
- (c) identifying a group of effective motion vectors by counting blocks in the current video frame having corresponding motion vector values within a first range of values bounded by the first average motion vector value minus a first threshold value and the first average motion vector value plus the first threshold value;
- (d) calculating a panning motion vector value to be equal to an average value of the effective motion vectors; and
- (e) correcting the error block by setting the motion vector of the error block to be equal to the panning motion vector value.

[Claim 2] 2. The method of claim 1, further comprising steps:

- (c1) calculating a percentage of all of the motion vectors in the current video frame which are effective motion vectors; and
- (c2) proceeding with steps (d) and (e) only if the percentage is above a predetermined percentage value.

[Claim 3] 3. The method of claim 1, further comprising steps:

- (d1) calculating a second average motion vector value of motion vectors corresponding to a plurality of neighboring blocks surrounding the error block;
- (d2) determining if the second average motion vector value is within a second range of values bounded by the panning motion vector value minus a second

threshold value and the panning motion vector value plus the second threshold value; and

(d3) proceeding with step (e) only if the second average motion vector value is within the second range of values.

[Claim 4] 4. The method of claim 3, wherein four neighboring blocks are used for calculating the second average motion vector value.

[Claim 5] 5. The method of claim 3, wherein eight neighboring blocks are used for calculating the second average motion vector value.

[Claim 6] 6. The method of claim 1, further comprising steps:

(d1) calculating a median motion vector value of motion vectors corresponding to a plurality of neighboring blocks surrounding the error block;

(d2) determining if the median motion vector value is within a second range of values bounded by the panning motion vector value minus a second threshold value and the panning motion vector value plus the second threshold value; and

(d3) proceeding with step (e) only if the median motion vector value is within the second range of values.

[Claim 7] 7. The method of claim 1, wherein the first and second threshold values are in the range of 0.5 to 3.

[Claim 8] 8. The method of claim 1, wherein the predetermined percentage value is in the range of 70% to 90%.

[Claim 9] 9. A method of correcting errors in motion vectors due to camera panning, the method comprising steps:

- (a) identifying a first error block that contains an error motion vector out of a plurality of blocks in a current video frame, each block in the current video frame containing a corresponding motion vector;
- (b) calculating a first average motion vector value of the motion vectors for all blocks located in a first section of the current video frame, the first section of blocks being all of the blocks in the current video frame that are located before the first error block;
- (c) identifying a first group of effective motion vectors by counting blocks in the first section of the current video frame having corresponding motion vector values within a first range of values bounded by the first average motion vector value minus a first threshold value and the first average motion vector value plus the first threshold value;
- (d) calculating a first panning motion vector value to be equal to an average value of the first group of effective motion vectors; and
- (e) correcting the first error block by setting the motion vector of the first error block to be equal to the first panning motion vector value.

[Claim 10] 10. The method of claim 9, further comprising steps:

- (c1) calculating a percentage of all of the motion vectors in the first section of the current video frame which are effective motion vectors; and
- (c2) proceeding with steps (d) and (e) only if the percentage is above a predetermined percentage value.

[Claim 11] 11. The method of claim 9, further comprising steps:

- (d1) calculating a second average motion vector value of motion vectors corresponding to a plurality of neighboring blocks surrounding the first error block;
- (d2) determining if the second average motion vector value is within a second range of values bounded by the first panning motion vector value minus a second threshold value and the first panning motion vector value plus the second threshold value; and

(d3) proceeding with step (e) only if the second average motion vector value is within the second range of values.

[Claim 12] 12. The method of claim 11, wherein four neighboring blocks are used for calculating the second average motion vector value.

[Claim 13] 13. The method of claim 11, wherein eight neighboring blocks are used for calculating the second average motion vector value.

[Claim 14] 14. The method of claim 9, further comprising steps:

(d1) calculating a median motion vector value of motion vectors corresponding to a plurality of neighboring blocks surrounding the first error block;

(d2) determining if the median motion vector value is within a second range of values bounded by the first panning motion vector value minus a second threshold value and the first panning motion vector value plus the second threshold value; and

(d3) proceeding with step (e) only if the median motion vector value is within the second range of values.

[Claim 15] 15. The method of claim 9, wherein the first and second threshold values are in the range of 0.5 to 3.

[Claim 16] 16. The method of claim 9, wherein the predetermined percentage value is in the range of 70% to 90%.

[Claim 17] 17. The method of claim 9, further comprising steps:

(f) identifying an Nth error block and an Nth section of blocks in the current video frame that are located between the (N-1)th error block and the Nth error block, N being an integer equal to or greater than 2;

- (g) identifying an Nth group of effective motion vectors by counting blocks in the Nth section of the current video frame having corresponding motion vector values within an Nth range of values bounded by the (N-1)th panning motion vector value minus a second threshold value and the (N-1)th panning motion vector value plus the second threshold value;
- (h) calculating an Nth panning motion vector value to be equal to an average value of the first N groups of effective motion vectors;
- (i) correcting the Nth error block by setting the motion vector of the Nth error block to be equal to the Nth panning motion vector value; and
- (j) repeating steps (f) through (i) until no more error blocks exist in the current video frame.

[Claim 18] 18. The method of claim 9, wherein the first section of blocks are the blocks located in rows above the first error block and the blocks located to the left of the first error block and in the same row as the first error block.